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SCIENCE NEWS LETTER

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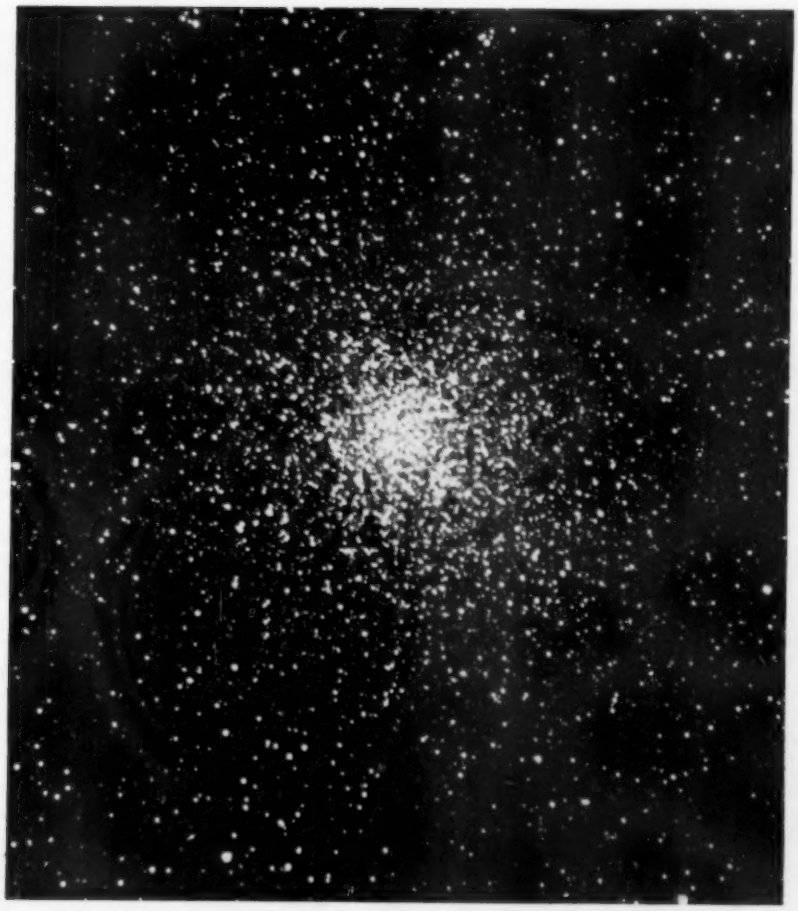

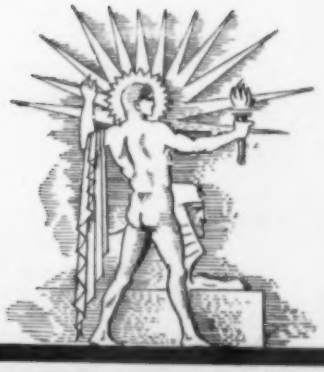

APRIL 30, 1932

Jewels for Andromeda's Necklace

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The Weekly Summary of Current Science

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? DO YOU KNOW THAT ?

Out of 1,735 forest fires in New York State last year, 918 were caused by smokers.

A study of deaf-mutes in Germany shows that about 10 per cent. of the cases are born deaf and 21 per cent. are the result of scarlet fever.

Excavations in downtown Philadelphia recently uncovered cypress stumps, one 17 feet in circumference, which grew there in an earlier geological age.

On the one-mile strip of highway near Kansas City that is experimentally lighted with 400-candle-power electric lights, automobiles can safely drive at night with only dim head-lights burning.

Weather observers find that on still, cold nights the temperature may vary by as much as ten degrees within a few feet of distance.

A new process makes the basic color of Portland cement tan instead of gray.

Firearms figure in at least two-thirds of the homicide deaths in this country.

Skeletons of two men and a woman, still wearing their rings and other jewelry, were recently found in the ruins of a villa in old Pompeii.

Soapstone was first used in the United States by the Indians, who recognized its heat-retaining qualities.

Tests show that white objects photograph sharply in the movies, and consequently pale gray materials are more commonly used for "white" clothing.

The Field Museum has a yellow silk handkerchief covered with thousands of tiny characters of Chinese writing, which is identified as a "pony" used by a Chinese student of the seventeenth century in taking an examination.

Electrically heated uniforms and shoes for traffic policemen have been demonstrated.

Until recently, the alligator pear appeared to have no insect enemies in California, but a spider, a beetle, and a scale have begun to make trouble for growers.

WITH THE SCIENCES THIS WEEK

CURIOSITY-AROUSING questions are prepared concerning the most interesting and important news in each issue. These questions should be a mental stimulant for the adult reader and a boon to the teacher who uses the Science News Letter to add zest to her classroom instruction.

Book reference in italic type is not the source of information of the article, but a reference for further reading on the subject of the article. Books cited can be supplied by Librarian, Science Service, at publisher's price, prepaid in U. S.

ARCHAEOLOGY

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Common tropical water-lilies have all colors but what? p. 273

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CHEMISTRY

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ECOLOGY

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What is the effect of ethylene gas on tomato plants? p. 283

PUBLIC HEALTH

How can leprosy be eradicated in the U. S.? p. 276

INVENTION

New Aid For Deaf Transmits Sound Through Bones or Teeth

Device, Serving Purpose Similar to Loud Speaker in Radio Set, Permits Afflicted Persons to Enjoy Music

A NEW device that brings radio and phonograph music to the deaf, not by way of the outer and middle ear passages but through their teeth or the bones of their heads, was demonstrated before the National Academy of Sciences, by Dr. Frederick Bedell, physicist of Cornell University.

Dr. Bedell describes his apparatus as a "deaf speaker," because it serves a purpose similar to the loud speaker in a radio set. The deaf speaker, however, does not broadcast sound, but carries it directly to the person who holds the receiving part of the apparatus between his teeth or pressed against cheek bone or forehead. To other persons in the same room, the apparatus is silent, which Dr. Bedell regards as one of the notable advantages of the device.

Defective Middle Ear

The theory upon which the physicist worked out his new speaker was that the majority of persons with defective hearing have a defective middle ear. His aim was to bridge that middle ear and bring the sound waves to the inner ear by some other channel.

By means of bone conduction this can be done. But it is not enough, Dr. Bedell found in his experiments, to transmit vibrations of the same frequency as the actual sound waves themselves to the inner ear of the listener. In order for him to hear through the bones, the vibrations must be adjusted to a suitable loudness, and force, and frequency. This adjustment is substantially what takes place in the normal middle ear. Dr. Bedell's deaf speaker achieves the adjustment by stepping up the force of the sound waves and making the amplitude or size of the waves smaller.

Since some persons are deaf to high tones and others fail to hear lower tones, the deaf speaker is provided with a means of fitting the type of tone to the listener's particular problem.

Dr. Bedell displayed two kinds of receiving instruments, or applicators, which he has developed. One kind is held between the teeth, and looks like a long tube. The tip, made of thin wood, is removable, so that more than one person may use the same machine without using the same mouthpiece. The other receiver, a face applicator, is a flat disk to be held against cheek bone or forehead.

False teeth, the physicist said, are no hindrance to hearing with the mouth applicator. The disk type of applicator makes it possible for the listener, by means of a microphone, to hear his own voice. This is an advantage to the hard of hearing who rarely are able to know how their own voices sound.

The apparatus can be used with a microphone for teaching the deaf, Dr. Bedell reported to the Academy meeting. The box containing the apparatus is portable, but is not small enough to be carried on the person for general use.

"Nearly 15,000,000 people because of defects in hearing are completely debarred or partly debarred from enjoying benefits of radio programs and phonograph music," the physicist stated. "The need therefore is evident for a deaf speaker which will give audition to the deaf similar to the audition given by a loud speaker to those having normal hearing."

That bone conduction can be used to carry sound waves to the inner ear has been recognized, but has not been widely applied in devising aids for the deaf.

It has long been known that, if a piece of cardboard is held before the mouth and one end of the board is caught under the upper teeth, curving the board, it is possible to hear conversation with the ears stopped. Greater volume of sound is necessary for bone conduction than for hearing through air passages of the ear.

Persons using a telephone often use bone conduction without thinking of it when they press the receiver tightly against the ear. The bone in front of the ear thus aids in catching the sound.

It is possible to hear music on a phonograph record by holding a long needle between the teeth and placing the needle in the grooves of the revolving record. This shows the principle of bone conduction although it is not a very practical working device.

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PHYSIOLOGY

Racial Factor Involved In Rate of Metabolism

THE RATE at which certain vital energy interchanges go on in the human body varies with different races, it appears from the report of Dr. Francis G. Benedict of the Carnegie Institution of Washington's Nutrition Laboratory

HEARING IN SILENCE

Dr. Frederick Bedell, physicist of Cornell University, using the face applicator which he demonstrated before the National Academy of Sciences.

at Boston, to the National Academy of Sciences.

Dr. Benedict studied measurements of the heat production which accompanies these changes in Mayas in Yucatan, in pure-blooded Aboriginals of the Kokata Tribe in South Australia, in Tamils and Malayalis in Madras, and in a group of American-born, pure-blooded Chinese girls of Boston. He found wide differences in the heat production of these various groups which could not be explained entirely on account of difference in size, dietetic habits, climatic conditions or sex. He concluded that the difference was due to the racial factor.

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ARCHAEOLOGY

Jewels Suggest Aztec King Lay in Monte Alban Tomb

Rings and Ornaments Found There Said to Bear the Hieroglyphics of "Fallen Eagle," Great Indian Hero

IN DISCOVERING the famous treasure tomb of Monte Alban Mexican archaeologists may have come upon the burial of "the fallen eagle," last of the Aztec kings. This is the suggestion brought to the attention of archaeologists by Mrs. Zelia Nuttall, well known American archaeologist of Mexico City.

Mrs. Nuttall's theory that one of the skeletons in the Monte Alban tomb may be that of Cuauhtemoc, last Aztec king, is based upon study of jewelry and other objects in the tomb. Certain of the rings and ornaments bear the hieroglyphs of the name of this great Indian hero, whose name meant "fallen eagle." Circumstances of Cuauhtemoc's death also dove-tail with evidence in the tomb, Mrs. Nuttall considers.

Cuauhtemoc became king of Mexico in the last stormy months of the Spanish Conquest. He refused to reveal the whereabouts of his country's treasure to the conqueror Cortes, in spite of the torture of having his feet burned. For this, the Aztec king has gone down in history and every Mexican school child knows his heroic story. He is commemorated in Mexico by many monuments, and streets are named after him.

Cuauhtemoc's last journey began when Cortes carried him along, as a prisoner, on an expedition to Honduras, in October, 1524. Cortes made this twenty-month march from Mexico City to Honduras in order to punish some subordinate who rebelled. He took the Aztec king, as he wrote the king of Spain, "because he was a dangerous man; and with him I took along also all the other lords I thought might start a revolution in that country."

The road the expedition took to the south was through the province of Oaxaca. The province had been subdued in 1521, and the sacred burial places of Monte Alban and Mitla had already been sacked by Spanish soldiers in search of treasure.

When the expedition reached Acalan, Guatemala, a chief from the Mexican state of Michoacan denounced the Aztec chieftains to the Spaniards. Cortes had them tried for conspiracy and hanged Cuauhtemoc and one other, but freed the rest.

History does not say what became of the body of Cuauhtemoc, but Mrs. Nuttall believes it must have been treated with all the honors accorded to the line of Aztec Montezumas, or chieftains, who were almost sacred personages to the Mexican Indians. The remains would have been disposed of in a safe and secret place worthy of nobility. No place more suitable could have been found, Mrs. Nuttall says, than Monte Alban, sacred city in Oaxaca's mountains on the road back to Mexico City from Honduras. Monte Alban must have seemed safe then, for it had already been sacked, and the Spaniards would probably not return a second time.

Mrs. Nuttall enumerates arguments that might tend to identify the skeletons in Monte Alban's treasure tomb as those of Cuauhtemoc and other Indians who died on the Cortes expedition.

No weapons of any kind were found with the bones, and that could mean that the dead were captive men. No idols were present, and this might be consistent for companions of Cortes, ostensibly converted.

There were fine red shell beads, unknown in Mexico, but common in trade among the Indians of Acalan, the place in which Cuauhtemoc died. Cortes states in a letter to his king that the Indians of that land presented them with gifts of gold and small red shell beads they used as money.

Two skeletons of the Monte Alban tomb stand out for the richness of their jewels, Mrs. Nuttall pointed out, and these might be the two Aztec chiefs that Cortes hanged.

Mrs. Nuttall's theory suggests an interesting and important line of research said Enrique Juan Palacios, Mexican archaeologist, who offers, however, an alternative explanation of the fallen eagle symbols. The eagle was the sacred animal of the sun among ancient Mexicans, Sr. Palacios says, and in a golden pendant where the eagle figure occurs, there are also four rays of the sun. The eagle descending could represent the overhead sun of midday, and Indians of Oaxaca actually did represent the midday sun as a diving being.

The only date on jewels of the Monte Alban tomb is "eleven House twelve Wind." Just as "Tuesday, April 19" can recur in our calendar at calculated intervals, so "eleven House twelve Wind" can recur in the Mixtec calendar every 52 years. From other evidence, Alfonso Caso, discoverer of the Monte Alban tomb, believes the burial was made at a time not remote from that of the Spanish Conquest. The nearest Mixtec dates, "eleven House, twelve Wind," before and after the Spanish Conquest, are 1477 and 1529. The first is too early to represent Cuauhtemoc's death, and the second too late, for his death occurred in 1525.

Buried Twice

It is pointed out by others, however, that Indians of Oaxaca and elsewhere, practised "secondary" burials. They buried their dead, and later, when the flesh was decomposed, the bones were exhumed and reburied. They were sometimes covered with gold leaf, and skulls were inlaid with turquoise and other precious substances. Tombs have been found in Mitla, Oaxaca, where entire skeletons were thus gilded, and in another burial found in Guerrero, in March, 1932, skulls were covered with gold foil. A cranium in the Monte Alban grave was also encrusted with turquoise.

The bones of Cuauhtemoc, buried perhaps in foreign soil in 1525, could have been brought back later by his people to the sacred city of the dead, Monte Alban, which had the fame of being an entrance to the other world.

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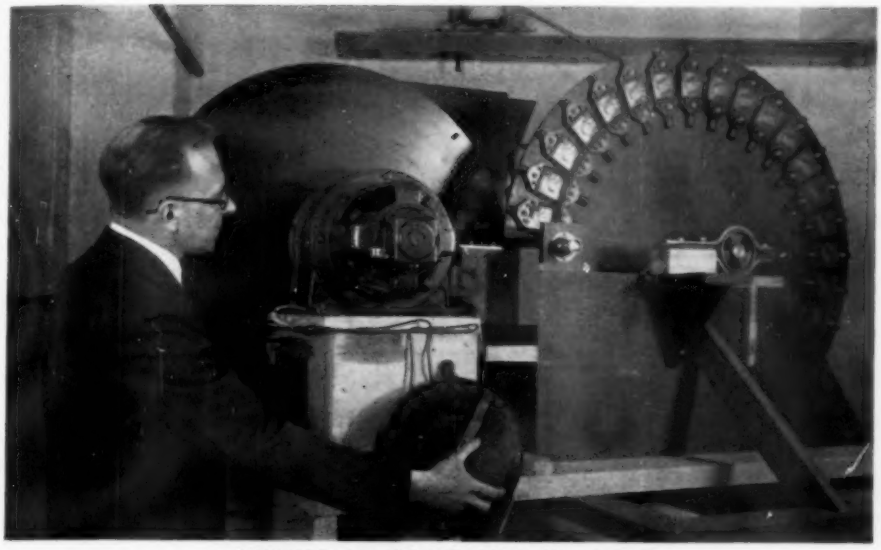

THIRTY-TWO SUCCESSIVE PICTURES

—mounted upon a wheel make up the brief stereoscopic motion picture developed by Dr. Herbert E. Ives, of the Bell Telephone Laboratories in New York. Behind the wheel is another wheel, in which may be seen the aperture which admits a flash of light as each picture reaches the projection point.

BOTANY

New Varieties Promised From Re-Found Tropical Water-Lily

ONE of the romantic stories that one often encounters in fiction, of men who spend years and risk lives combing the tropics for a rare and beautiful flower, was disclosed as actual fact by Dr. George T. Moore, director of the Missouri Botanical Garden, St. Louis. Speaking before the meeting of the American Philosophical Society, he told of the successful outcome of a search lasting more than forty years, for a yellow tropical water-lily.

It has often been remarked, Dr. Moore said, that whereas water-lilies of the temperate zones are of all colors but blue, tropical water-lilies have all colors but yellow. From the flower-lover's point of view, a yellow tropical water-lily would be more precious than much fine gold, because it could be crossed with the water-lilies of other colors to produce new varieties.

In 1890 a yellow water-lily was sent out of Africa by a collector named Stuhlmann, as a dried and pressed botanical specimen. The flower was duly named in his honor, and other men sought it again to obtain its seed; but for forty years they found nothing but disappointment.

At last, in 1929, the Missouri Botanical Garden received from a British botanist in Africa, B. D. Burtt, seeds of a water-lily that had grown in a swamp with big flowers of a spectacular primrose-yellow color. Of over three thousand seeds he sent, only one germinated and grew to maturity. Its flowers, in its northern land of exile, were nothing spectacular in size, but they were the long-sought yellow in color.

Crosses were made with every tropical water-lily that promised the least chance of success, and last year the first crop of hybrid flowers developed. Of the eighty first-generation hybrids, one is a conspicuous success. It was obtained by crossing the yellow water-lily with a white tropical species, and its yellow blooms are of such splendor that it was considered worthy to be named the "St. Louis," in honor of the city of its nativity.

All the rest of the hybrids, with tropical blues and pinks, have shown the yellow to be dominated by the other two colors in the first generation. Crosses have been made with these, however, and they have also been inbred, and the blooming of their offspring is an event awaited with much interest.

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PHOTOGRAPHY

Elaborate Apparatus Makes Three-Dimension Movies

MOTION PICTURES in which the actors "stand out from the screen" and appear in relief have been produced with experimental apparatus devised by Dr. Herbert E. Ives of the Bell Telephone Laboratories in New York. Dr. Ives reported his experiments before the meeting of the National Academy of Sciences.

The apparatus for producing such pictures is quite elaborate. Instead of a lens, the camera uses a four-foot concave mirror, like those used in reflecting telescopes. It reflects the image of what it "sees" on a transparent screen consisting of 200 minute concave grooves. Here photographic records of successive exposures are made, not on motion picture film, but on small photographic plates.

Prints from these negatives are then mounted on a large disk, which brings them in slow succession into position in the projecting machine, while another smaller disk, rapidly rotating, flashes light through the lenses. The projection screen consists of 200 quarter-inch transparent rods, whose front and rear surfaces focus the light to form the apparently solid moving images in the projection space.

Immediate commercial application is hardly expected, Dr. Ives stated, because of the difficulty of obtaining the extreme accuracy of all mechanical and optical adjustments necessary for successful operation.

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ECOLOGY

Nocturnal Animals Subject Of Study by Scientists

STUDYING beetles under the bark of trees with the aid of a flashlight is part of the job of learning what animals do at night within the forest depths. Three scientists, Orlando Park and John A. Lockett, of the University of Illinois, and Dwight J. Myers, of Kent State College, Ohio, made observations on the behavior of nocturnal animals in two beech-maple forests of northeastern Ohio.

Nineteen species of beetles were observed during the ecological study, as well as frogs, salamanders, snails, ants, and millipeds. Nocturnal ecology was pointed out as being a practically untouched field of scientific research.

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ASTRONOMY

Venus, Queen of May Evening Skies

This Planet Reaches Its Maximum Brilliance on the 22d And Is So Bright as to Cast Shadows of Earthly Objects

By JAMES STOKLEY

BY FAR the brightest object in the May evening skies, except, of course, the moon, is the planet Venus. In recent months it has been a conspicuous feature of the western sky for a few hours after sunset. It has steadily been increasing in brilliance, and on the twenty-second it will be at its maximum brightness. In the astronomer's scale it will be of the minus 4.2 magnitude, which is within a tenth of a magnitude of the brightest that it can possibly be. Of the other planets, only Mars ever becomes nearly as bright. When it makes its closest approach to the earth, as it did in 1924, it attains a magnitude of minus 2.8, which is only a little more than a quarter as bright as Venus this month. Both Venus and Mars are planets, members of the sun's family. The brightest of the fixed stars is Sirius, the dog star, of minus 1.6 magnitude, one-eleventh as bright as Venus.

If you look at Venus now through a small telescope, magnifying perhaps twenty or thirty diameters, you will find that it is not a single point of light, like a star. Neither is it a round disc, like the appearance that Jupiter or Mars presents through the telescope. Instead, it now has a crescent shape, like the almost new moon. But if you had observed Venus through the telescope a few months ago, you would have seen, not a crescent, but a disc, and of considerably smaller diameter than the present crescent. Had you continued to observe it, you would have found that the diameter gradually increased. As it did so, the disc changed to a gibbous phase, like that of the moon between first quarter and full. Finally the shape of Venus was semi-circular, like a half moon. This happened on the nineteenth of April. Up to this point, the planet was moving away from the sun, appearing higher and higher in the western evening sky. Since April 19 it has been drawing towards the sun, but the telescope would show that it is still increasing in size, while the half-moon shape has changed to a crescent, which is gradually narrowing.

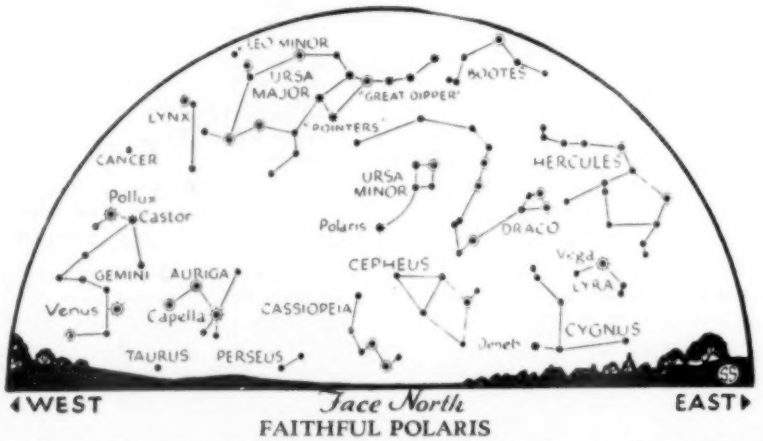
This change takes place because the orbit of Venus is within that of the earth. Venus revolves around the sun at a distance of about 67,170,000 miles in 225 days, while the earth, at a distance of 92,900,000 miles takes 365 days for one revolution in its orbit. Sometimes, therefore, Venus is directly between the sun and the earth, while on other occasions the earth and Venus are on opposite sides of the sun, and then the planet is invisible. But after it has passed superior conjunction, which is the name given to its position when on the opposite side of the sun from the earth, it comes into view. Then the light of the sun, which is the only illumination it has, shines on it in the same direction that we view it. We see almost all of the illuminated half, and it presents the appearance of a disc.

Half-Moon Shape

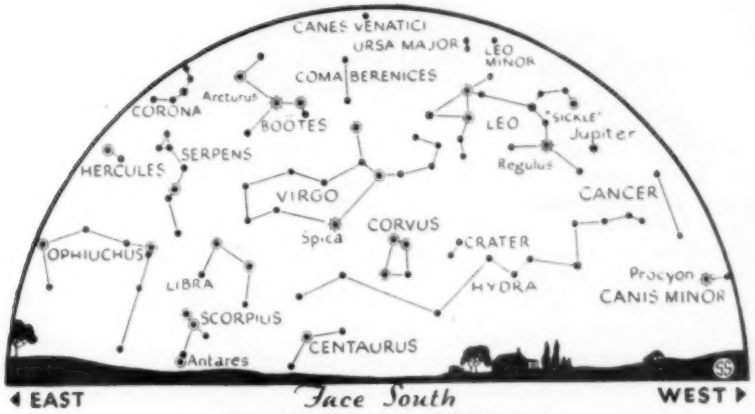
Then, as it moves farther around its orbit, it gets to the east of the sun, and so we see it after sunset. Finally it reaches a point where a line drawn from the earth to Venus would be at right angles to one from Venus to the sun. Then the planet is said to be at greatest eastern elongation, for after that it seems to draw toward the sun again. At this time we see just half of the illuminated hemisphere of Venus, so the planet has the half-moon shape.

Now it is moving to a point between the sun and the earth, and is still approaching closer to us. On May 1 it is 58,000,000 miles from us. As it continues to approach, it appears larger and larger on succeeding nights. But now we see less than half of the illuminated hemisphere, and it presents the appearance of a crescent, just as the moon does, and for the same reason. The main difference between the phases of Venus and those of the moon, however, is that as the latter occur the moon remains at the same distance from the earth, about 239,000 miles, and so there is no corresponding change in diameter. The moon, therefore, is brightest when full, and we see the whole sunlit half. Venus is brightest when in the crescent phase. Then the illuminated part that we see covers the largest area of the sky, as happens on May 22. After that the diameter of the planet continues to increase, but the crescent becomes so much narrower that its light decreases, and at the same time it moves into line with the sun, where it is harder to view.

But even this does not account entirely for its great brightness at present. Venus, like the sun, moon and all the planets, moves along a path called the ecliptic, which is inclined to the celestial equator, an imaginary line in the sky directly above the earth's equator. It is for this reason that the sun is farther north in the summer than in the winter. In the same way, when Venus makes an appearance in the spring evening sky, it is farther north,



Sharing the northern stage with Venus during May evenings are Gemini, the twins, with Pollux its brightest member. Just coming into view low in the northeast is Cygnus, the swan, and the star Deneb. A little higher is Lyra, the lyre, with bright Vega. Faithful Polaris, in line with the pointers of the Great Dipper, holds the axial position.



WITHOUT HIS RETINUE

The evening of May 3 will present an unusual sight. Jupiter will be visible but without the four satellites which ordinarily accompany him. They will be blotted from view as they pass either behind the planet or across its face or are hidden in its shadow. This phenomenon was last witnessed from the United States in 1914.

or higher, than when in the evening sky at other times of year. Therefore, its light is less dimmed in its passage through the earth's atmosphere. In fact, Venus is so bright now that it casts a perceptible shadow, a fact which you can verify if you go to a place where it is quite dark, and no artificial lights are near. By holding a piece of white paper so that the light from Venus falls upon it, and then moving your hand around in front of it, you can easily discern the shadow. Of course, this should not be tried when the moon is visible and flooding the earth with its own light.

The other bright planet in the May evening sky is Jupiter, now of the minus 1.5 magnitude, about the same as that of Sirius. Since Sirius is not now visible, Jupiter is the second brightest object in the evening sky, excepting the moon. It is in the constellation of Cancer, the crab, now in the southwest. The position of the planet is shown on the accompanying map, and its brightness makes it easy to identify.

Invisible from America

Early in May it presents a very unusual aspect—on the evening of May 3 it will be seen without any of the satellites which almost invariably accompany it when seen in a small telescope. Not since 1914 has such a condition been seen from the United States. In that year it also happened in May. It also occurred on March 4, 1919, and on February 4, 1931, but at times when Jupiter was invisible from the United States. It will occur again on November 20, this year, but not at a time to permit America to see it. We shall have to wait until July 16, 1939, for the next appearance of Jupiter without satellites. Thus the phenomenon is considerably more rare than a total eclipse of the sun, though it is not nearly so important scientifically.

The four large satellites, or moons, of Jupiter were discovered by Galileo in 1610. They are bodies as large as the smaller planets, and easily visible in a small telescope. The other five satellites of Jupiter are much smaller bodies, seen only through powerful instruments. If you watch Jupiter from night to night through a telescope, you will see the four moons continually moving around the planet. One night three may be on one side and one on the other, then all may be on the other side.

Frequently one of the satellites may vanish from sight. This occurs for one of three reasons. Either it passes behind Jupiter; or it enters Jupiter's shadow, eliminating the sunlight by which we ordinarily view it; or it comes in front of Jupiter, when it cannot be easily distinguished from the planetary background. Sometimes two satellites may disappear simultaneously, still more rarely three may vanish together, and, at very rare intervals, all four may disappear, as they do this month.

Though these moons have names, Io, Europa, Ganymede and Callisto, they are frequently referred to by number, I, II, II and IV. At 7:45 p. m., eastern standard time, on the third, II is occulted as it passes behind Jupiter. At 8:51, IV is eclipsed as it enters the planet's shadow. At 9:04, I disappears as it transits across the planet's disc. Finally, before any of these have reappeared, at 10:25, III is eclipsed. From this time until 11:20, no satellites are seen. At 11:20, I emerges from its transit across the disc, and again is seen floating in space beside the planet. Soon after this Jupiter sets for observers in the eastern part of the country, but people in the West will see the reappearance of II at 1:07 a. m., eastern standard time, of IV at 1:43 and of II at 2:02.

Nine first magnitude stars can be seen in the May evening skies, though some of them are so close to the horizon that their light is considerably dimmed and they may appear even fainter than a star that is really not as bright, but is riding high in the heavens. The accompanying maps allow for this absorption, and show the stars as they appear.

Above and to the left of Jupiter is the "sickle," part of the constellation of Leo, the lion. The star Regulus is at the end of the handle. In the southern sky is the first magnitude star, Spica, part of Virgo, the virgin. Above her is Boötes, with the brilliant Arcturus. In the western sky, near Venus, is Gemini, the twins, with Pollux its brightest member. Below, and to the left, is Procyon, marking Canis Minor, the lesser dog. Capella, in Auriga, is low in the northwest. Low in the northeast Cygnus, the swan, with the star Deneb, is coming into view, while a little higher is Lyra, the lyre, with Vega. Scorpius, the scorpion, is low in the southeast with the star Antares close to the horizon.

During the month of May the moon is new on the fifth, at first quarter on the thirteenth, full on the twentieth and at last quarter on the twenty-sixth. Thus, moonlight evenings are indicated from the tenth to the twenty-third.

Science News Letter, April 30, 1932

CHEMISTRY

American Rediscovers Lost Chemical Compound

A CHEMICAL compound prepared for the first time seventy years ago, and since then "lost" in such uncertainty that chemists had concluded it did not really exist, has been rediscovered by Prof. W. A. Noyes of the University of Illinois.

The compound is nitryl chloride, represented by the formula NO_2Cl. It was first prepared by a German chemist, Richard Müller, in 1862. Afterwards a number of other chemists tried their hand at repeating Müller's work, with very uncertain success.

Nitryl chloride is a pale yellowish-brown gas, quite unstable chemically and very ready to break apart and enter into reactions with other substances. Because of the difficulty of preparing it and of its instability it has no practical uses.

Science News Letter, April 30, 1932

METALLURGY

Steel Made Super-Hard By Rapid Chromium Plate

AN INTENSELY hard surface is put on steel tools to increase their usefulness many times by a process of rapid chromium plating reported to the Electrochemical Society by Lieut. A. Willink of Frankford Arsenal, Philadelphia.

As an alloy, chromium made steel stainless; as an electroplate, it gave automobile parts an ever-shiny, non-rusting finish and it hardened tools and parts of machinery subject to great wear. Now, by a method of rapid plating at high temperatures described by Lieut. Willink, it imparts to tool steel a coat of super-hardness.

He said that a certain die plated by the new method would stand up for 85,000 impressions in the Frankford Arsenal. Protected by an ordinary chromium plate it had a life of about 25,000 impressions and without chromium protection it was useless after a 4,000 run.

The new method has the additional advantage of requiring much less time than the old. Plating is done in a bath at about 150 instead of 65 degrees Fahrenheit and the current density is at least 1,000 amperes per square foot of plating surface.

Science News Letter, April 30, 1932

PUBLIC HEALTH

Eradication of Leprosy In U. S. Held Possible

"IT OUGHT to be possible to eradicate leprosy in the United States in the space of a few years," declared Dr. Victor G. Heiser of the International Health Board at the meeting of the American Philosophical Society.

There are said to be 2,000 cases of leprosy in the United States at the present time. The disease is only transmitted now in Florida, Louisiana, Texas and California, though it is not so long since cases originated in other states as well, Dr. Heiser said. There still are cases of leprosy in some of the other states, but no new cases occur, he explained.

Leprosy cannot be eradicated by direct attack, as can be done in the case of diphtheria or bubonic plague, for instance, because too little is known about the disease. But much may be accomplished by securing hygienic living for the patients, by early treatment, isolation, and other "common sense" methods, Dr. Heiser stated. Speaking of wiping the disease out of the United States, he said:

"In the light of present knowledge it would only be necessary to send all the afflicted persons of Louisiana, Florida, Texas and California to the Federal hospital at Carville, Louisiana. In these states active steps should be taken to find the early cases and have them brought under treatment.

"In countries like India, China, and Japan, where the large numbers of sufferers would involve prohibitive hospital costs, outdoor or dispensary treatment could be given and patients taught how to avoid endangering others."

Dr. Heiser reviewed the present methods of treating leprosy and pointed out that in those having a good effect, it may be due to their capacity to cause fever, which has recently been found helpful in treating other diseases.

Science News Letter, April 30, 1932

ASTRONOMY

Electric Waves May Cause Variability in Stars

VARIABLE stars, the flashing signs of the sky that periodically wax and wane in brightness, may do so as a result of electrical changes. R. W. Revans, Commonwealth fellow from Cambridge University, who is working in the physical laboratories of the University of Michigan, makes this suggestion as a result of his experiments with an artificial variable star.

Mr. Revans used a spherical glass tube containing gas, to which was connected a source of high voltage. He found that the electrical discharge inside the tube occurred in oscillations, starting at the center and spreading to the outside. These oscillations occur at the rate of 10,000 times a second, while the variations of a star may take days. But he applied his experimental data to a hypothetical tube of the size of a star, and found that the period would then be about the same as those actually determined by astronomers.

This may prove important in determining the actual brightness, or candle power, of a variable star. By means of the spectroscope, the external temperature may be measured, and from the work of Mr. Revans, the diameter may be calculated. Thus the intrinsic brightness may be found. By comparing this with the apparent brightness, as the star is seen in the sky, the distance can be measured.

Science News Letter, April 30, 1932

IN SCIENC

ASTRONOMY

Great Groups of Stars Have Same Candlepower

STARS that are not as hot as the sun are sharply separated into two classes, giants and dwarfs—enormous bubbles of glowing gas of very low density, and smaller globes, still gaseous, but more highly compressed in their interiors. And between these two classes the cooler stars show no examples of intermediate size.

This was among the new facts about stars presented before the meeting of the National Academy of Sciences by Dr. Walter S. Adams, director of the Mt. Wilson, Calif., Observatory of the Carnegie Institution of Washington, based on observations which he has made on 4,000 of the brighter stars. The examples with which he was particularly concerned were those that showed temperatures from 10,000 down to 3,000 degrees Centigrade.

Dr. Adams made the further discovery that all of the cooler giant stars are of about the same brightness. Similarly, all the cooler dwarfs shine within definite narrow limits of luminosity.

"An immense majority of such stars," he said, "have almost exactly the same candlepower."

Science News Letter, April 30, 1932

PLANT PHYSIOLOGY

Shade Trees May Detect Slow Leaks In Gas Mains

IF ONE or two shade trees in a row along the street begin to put forth their leaves and flowers prematurely, while their companions still remain dormant, it may mean that the gas main beneath their roots has developed a slow leak.

This suggestion is made by Prof. Carl G. Deuber of Yale University. Prof. Deuber states that illuminating gas, long recognized as poisonous to plants, acts as a stimulant when present in low concentrations. In this it resembles many other poisons.

Science News Letter, April 30, 1932

NCE FIELDS

GENETICS

All-Male Cornstalks Produced by Scientist

CORNSTALKS that are all male, and their counterparts that are exclusively female, have been bred by Prof. R. A. Emerson, Cornell University geneticist, who reported on his researches before the meeting of the National Academy of Sciences.

The ordinary type of corn is both male and female. The female flowers, that produce the seed, are grouped in the ears; the male, or pollen-bearing flowers, occur in the tassel. In Prof. Emerson's all-male corn the tassel is of the ordinary, pollen-producing type, but there are no ears. In his all-female corn the ears are present, and the tassels, instead of producing pollen, bear female flowers that give rise to grains of corn.

Prof. Emerson has succeeded in analyzing the Mendelian hereditary characters that are responsible for this strange behavior in his two corn strains, and described them to the Academy.

Science News Letter, April 30, 1932

MEDICINE

Infantile Paralysis Germs Reach Brain Through Nose

THE GERM or virus causing infantile paralysis is not carried by lower animals but is confined to man. It enters the body chiefly through the membranes of the nose, and passes along the nerves of smell to the brain and spinal cord, where its main attack on the body is made. These are the conclusions which Dr. Simon Flexner, director of the Rockefeller Institute for Medical Research, reported to the National Academy of Sciences.

The germ's chief avenue of escape from the body is back along the nerves of smell from brain and spinal cord to nasal membranes, Dr. Flexner said. This indicates that the nasal secretions carry the germ and may be the means of spreading it to cause new cases of the disease.

Dr. Flexner also described experiments intended to develop successful methods of giving monkeys lasting protection against or immunity to the disease, and studies on the variation of the causative virus under varying conditions of growth.

Monkeys can be protected for relatively short periods of time, he explained, by inoculating them with blood serum from human beings who have recovered from the disease, from monkeys given the disease experimentally, or from certain adult persons not known to have had the disease, but whose blood sera nevertheless give protection.

Lasting, active immunity to the disease can be given monkeys by inoculations of the infantile paralysis virus or germ itself. The methods heretofore used to produce this type of immunity have been uncertain because in a few instances they have been followed by paralysis. For this reason active immunization has never been tried in man. Dr. Flexner's latest experiments were undertaken in the hope of improving the method of giving active immunization to monkeys.

Science News Letter, April 30, 1932

CHEMISTRY

Double Weight Hydrogen Unit in Atom Building

HYDROGEN atoms of double weight, recently discovered at Columbia University, are fundamental building blocks in the cores of other atoms, Prof. William D. Harkins has shown by assembling the data on the frequency of occurrences of atom species. His findings have been reported to the *Journal of the American Chemical Society*.

The most abundant kinds of atom cores, Prof. Harkins points out, are those which can be made up entirely of the cores of the new double-weight hydrogen isotope. This unit, consisting of two positive protons and one negative electron firmly bound together, is next to the proton itself in simplicity as a structural unit of matter. Two such "isohydrogen nuclei," themselves tightly bound, make up the alpha particle already widely recognized by scientists as a building stone in the formation of atom cores.

The double-weight hydrogen atom was discovered a few months ago, by Prof. H. C. Urey and Dr. G. M. Murphy of Columbia University in collaboration with Dr. F. G. Brickwedde of the U. S. Bureau of Standards.

Science News Letter, April 30, 1932

BACTERIOLOGY

Years Fail to Change Old Bacterial Cultures

BACTERIA do not wholly deserve the reputation they have been getting lately, of being exceedingly fickle and changeable creatures, never "staying put", for long, under laboratory conditions.

So in brief, said Prof. E. B. Fred of the University of Wisconsin, who spoke before the meeting of the National Academy of Sciences.

Bacteria in the laboratory undergo two types of change, said Prof. Fred. One is the type that has been receiving much attention lately: the kind of rapid evolution that produces a strain or variety of bacteria recognizably different from the culture as it started out but keeping the new characters indefinitely. The other type of change might be termed, with a little poetic license, the production of "slum" bacteria; for in this kind of change the germs suffer degenerative changes from the "unnatural" conditions to which they are subjected on being kept in culture flasks and tubes for long periods.

However, if attention is paid to keeping laboratory conditions right, these degenerative changes need not set in, Prof. Fred declared. He cited the cases of a number of bacterial cultures he had kept in his laboratory for periods as long as twenty years. When the physiological reactions of these "ancient" cultures were compared with those of brand-new cultures of the same species, the old bacteria proved to be indistinguishably similar to the new.

Science News Letter, April 30, 1932

ASTRONOMY

Planet Discovered in 1930 Was Photographed in 1914

NEARLY sixteen years before the ninth planet, Pluto, was discovered, it was photographed at Harvard College Observatory. Its image has just been found on a photographic plate by Miss Arville D. Walker after Dr. E. C. Bower of the University of California had computed where the planet should have been on the night of November 11, 1914, when the plate was exposed through the 16-inch Metcalf telescope at Cambridge. Pluto was discovered at Lowell Observatory, Ariz., early in 1930.

Science News Letter, April 30, 1932

PHYSICAL CHEMISTRY

Ostwald on Chemical Energy

"A Classic of Science"

Wilhelm Ostwald, Who Died in Germany April 4, Pioneered In Applying the Laws of Energy to Problems of Chemistry

ON CHEMICAL ENERGY. By Dr. W. Ostwald. Read before the World's Congress of Chemists, August 26, 1893. *Published in the Journal of the American Chemical Society, vol. XV., August,* 1893.

THE knowledge of the laws of chemical energy is not only scientifically but practically of the greatest interest. All energy, which is employed in accomplishing the various purposes of industry, is derived from chemical sources, the combustion of fuel. Besides, each step that we take, every word that we speak, in fact every thought formulated by our brain, leads to sources of chemical energy; animals and plants throughout their whole existence are based primarily upon chemical energy and its laws, and the ultimate problems of biology are in every respect chemical.

All forms of energy have this in common, that they may be resolved into two factors, both of which have definite properties. The one, which we call intensity, determines whether the energy may remain at rest or must undergo an exchange. Thus, for instance, the factor of intensity for heat is temperature, since we know that two bodies can be at rest with reference to their heat only when their temperatures are equal. The second factor we call capacity; it determines how much energy at a given intensity is present in the object under consideration. With heat for instance, this is called heat capacity.

Factors of Chemical Energy . . .

What now are the factors of chemical energy? If we had a measure for its factor of intensity, as the thermometer is a measure of the intensity of heat, we would be able to determine for each substance with reference to another whether it could react with the latter or not, just as the thermometer shows us whether or not heat can be transmitted from one body to another. Our answer is that this question has not been completely solved, but that from many phenomena we already possess a *chemometer,* as we might call the instrument—in analogy to the thermometer.

In order however to be able to explain the theory of the chemometer, the factors of chemical energy must first be more precisely determined. The factor of capacity is in this case most easily discovered. The chemical energy which is present under given circumstances is proportional to the weight or mass of the substances involved. Hence we sell and buy chemical energy according to weight. This becomes more clear from the following consideration: When we buy coal, we do not consider the carbon present, but rather the chemical energy, since in the use of the fuel we allow the carbon to escape quietly through the chimney as carbon dioxide, without making any effort to retain it; that however which we husband with the greatest care, is the chemical energy of the coal, obtained as heat. I have stated with due consideration that the factor of capacity of chemical energy is proportional to the mass; yet it is not mass, since this conception belongs solely to mechanics. It is therefore by no means more correct to say "atomic mass" instead of "atomic weight," since in this case the degree of chemical capacity is concerned which is proportional to both weight and mass, without being one or the other.

The term "degree of intensity" of chemical energy has something in common with the conception which has become familiar in the field of chemistry under the term of "chemical affinity," more to denote that field in which a more accurate knowledge was especially desirable than to combine by such a word sufficiently definite ideas. The word was there, just as the name of a future street stands on a signboard in the outskirts of a city, in a waste field; tents and barracks of the most curious kinds have been erected from time to time only to be deserted again. Only in most recent times solid buildings and permanent settlements have found a place on this site, and soon a new section of the city will be created there, whose importance threatens to throw the older portion of the city in the shade.

J. Willard Gibbs called the degree of intensity of chemical energy the chemical potential; analogous to the degree of intensity of electrical energy, which is called the electrical potential. So, to avoid the vagueness of the term *affinity,* we will make use of the term chemical potential, or in brief, potential.

Now, it follows from the definition of the degree of intensity, that two substances with like potential can not act on each other; and, conversely, that when two substances act on each other their potential must be different.

Equally Meaningless . . .

That general law which can be regarded as expressive of the Second Theorem holds also for the chemical potential, namely: Two potentials which individually are equal to a third are equal to each other. This proposition seems quite self-evident, and therefore equally meaningless. Yet we can draw from it conclusions that are very far reaching. It says that two bodies or groups of bodies which are in equilibrium with each other, can mutually replace each other at pleasure towards a third system in every reaction in which this third system (towards which equilibrium has been established) can react. Thus, for example, every soluble body can be replaced by its saturated solution, every liquid by its saturated vapor, every solid body at its fusing point by the melted body without causing any alteration in the equilibrium depending upon the former. Among other things this shows that while the heat of solution, fusion, and evaporation, change the evolution of heat during a chemical process,

The mysterious malady

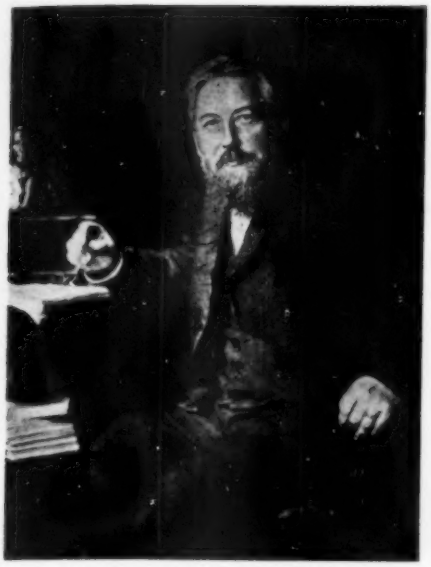
Hay Fever

was first described by

BOSTOCK

in 1819. His description is

THE NEXT CLASSIC OF SCIENCE



DR. WILHELM OSTWALD

In addition to his work on the laws of physical chemistry, he invented a process of oxidizing ammonia which is fundamental to one of the methods of obtaining nitrogen from the atmosphere.

they do not thus affect the equilibrium. The thermal theory of affinity, which is even today championed by Berthelot and others, is by this circumstance proved to be quite untenable.

It is natural in the case of such a far-reaching proposition to require proofs. This proof is found in the fact that it is impossible to create a *perpetuum mobile*. To have a *perpetuum mobile* it is not necessary to create energy from nothing, but only to transform potential energy into kinetic. If it were for instance possible to transform the constant heat which is present in enormous quantities in the ocean into work which then could change back into heat, we would require no more coal to propel our steamships, since all the work which we required for their propulsion would be transformed into heat by friction and could return to the ocean in unchanged amounts. Such a *perpetuum mobile* will be instantly possible when two substances which individually are in equilibrium with a third are not in equilibrium with each other. If we assume that a substance *A*, when in contact with a large body *B* (the ocean), assumes a temperature which is different from that imparted to a body *B*, simultaneously in contact and equilibrium with the ocean, we would cause a transmission of heat between *A* and *B* which would be capable of driving a machine. This proof is equally true for every other form of equilibrium and for every form of energy, and thus we also prove our chemical proposition.

When we have thus recognized the conditions under which energy is in equilibrium or at rest, we can directly reason that energy can not be at rest when its potentials are different. A process must then take place by means of which they become equal. This is the most common phenomenon with which we are acquainted; everything which takes place is based, in the last instance, upon an equalization of energies of different potentials.

Since, however, energy, as is a fact, has a never-ceasing tendency to equalize itself, the question arisese why it has not done so long ago during the many thousand years which our system of worlds has existed. We continually see differences of potential existing in nature—compressed air, galvanic elements; all these contain stores of energy which are ever ready to act and must therefore be unequal. Likewise the fossil fuels and the sulphides of the metals are able in conjunction with the oxygen of the air to bring forth large amounts of energy during their inter-action, and can not, therefore, be in equilibrium. Aside from the tendency for equalization, which is peculiar to energy, other forces are therefore active in nature which hinder or detain this, and an accurate understanding of these natural phenomena can only be attained when these opposing and detaining causes are known.

Equalization is Prevented . . .

For mechanical and electrical energy such hindrances can be easily created. A spring may be kept wound by a weight; two electrically charged bodies, which tend to approach each other, can be kept from attaining their equilibrium by the dielectric resistance of an interposed medium. All these hindrances however have but this explanation, that the differences of energy present are compensated by the use of other energies, so that their equalization is prevented; at the same time, we can prove that, according to the method employed, large quantities of one form of energy of any magnitude can be compensated by equally small quantities of another form of energy, for by means of a small switch, enormous currents of electricity can be interrupted and closed at will.

In the case of chemical energy we are however very often unable to prove such compensations by the application of other energies. When a piece of wood is exposed to the air, it would be in accordance with the general tendency to equalize the energy present, if combustion took place and the wood combined with the oxygen of the air. The same would apply to organized bodies. Our body consists of combustible substances; and, in accordance with the chemical affinities present, it should combine with the oxygen of the air and burn without cessation. Why is it not consumed?

If we should attempt to answer this question we should soon become entangled in inexplicable contradictions. We can not ask: "Why is our body not consumed?" since it does actually burn. It continually takes up oxygen and gives off carbon dioxide. The same answer applies to other chemical phenomena. A stick of sulphur exposed to the air seems unchanged, but it is only apparently so. In reality it is oxidized; slowly however, and so slowly in fact, that we would not notice it in weeks or months. If the process were however continued for years or decades of years the oxidation could be measured. The rapidity of reaction is clearly proportioned to the suface. If we take finely powdered sulphur, flower or milk of sulphur, whose total surface is much greater, we can prove the formation of sulphuric acid in hours and days.

What has here been stated for a few cases is a general truth. In every case where different substances which could act upon one another are in contact without having, practically speaking, any apparent action upon each other, we can bring the requirements of the teachings of energy into unison with the actual conditions by actually ascribing to these substances an action which is, however, so slow that it lies beyond the possibilities of measurement.

We have here the means of entering upon one of the most important and mysterious problems, namely, the search after the chemical activity of organized bodies, for, as all the activity of organisms depends upon changes in their chemical energy, all knowledge in this case depends upon a correct elucidation of the character of the chemical changes. If we can understand how the chemical processes of combustion, to which all physiological sources of energy finally lead, can be so regulated that they are able at any moment to adapt themselves to the ever-changing requirements of the organism, we have taken a step in every respect most important in the knowledge of life.

Let us take, for instance, a mixture of oxygen and hydrogen. Under ordinary circumstances we can preserve this mixture for a long time without the for-

mation of a measurable amount of water. If however we place a piece of platinum sponge into it the formation of water immediately begins, and is as suddenly terminated when we remove the sponge. The platinum sponge has moreover undergone no change and is able to exert this action for an unbounded space of time.

At first it seems as if we had here the first proposition of our later natural science, to rudely dispute "causa arguat effectum," since we have here a cause which can bring forth extended and large effects at pleasure without becoming exhausted. If we ask however what this proposition means by cause and effect we find it to be degrees of energy. No energy of any kind can be created without the consumption of an equal amount of energy, and no difference in the potential of energies can be called forth without the simultaneous disappearance of equivalent differences in the potential of other energies. The truth of these propositions is not cast in doubt by the experiment with the mixture of oxygen and hydrogen, since the heat of combustion remains the same both when combination is effected by an electric spark and when it is brought about at the ordinary temperature by means of platinum sponge. While therefore the law of cause, clothed in the form of a principle of energy, regulates the final result of the action in an unchangeable manner, the time during which this action takes place remains absolutely independent of this principle, and we have side by side with the absolute necessity of this law of cause, the freedom with reference to the time during which it exerts its influence. Therefore we see that all possible phenomena which, originating from the same substances, reach the same products, arrive at these with a very different rapidity. The object to be arrived at is unchangeable; whether it is however to be accomplished in a second or in several thousand years is a circumstance over which we have full control.

The name "catalytic bodies" has been given to substances which cause chemical reactions without experiencing any change themselves. We will now change this definition so as to read thus: Catalytic substances are those which modify the rapidity of a definite chemical reaction without changing their own content of energy. To place a catalytic substance into the reacting bodies and to remove it requires theoretically no work. This proves that within the strict province of the law of energy there still remains room for the greatest variation in the temporal extent of the phenomena.

This peculiar circumstance has its foundation in the fact that in the expression of most degrees of energy time is not mentioned, and that therefore the equation of energy does not determine the extent of time involved in the phenomena.

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RADIO

The Science Service radio address next week will be on the subject of

POISON IVY AND WHAT TO DO ABOUT IT

Dr. James B. McNair

botanist of the Field Museum of Natural History, Chicago, will be the speaker.

FRIDAY, MAY 6

at 2:45 P. M., Eastern Standard Time

Over Stations of

The Columbia Broadcasting System

ARCHAEOLOGY

Shakespeare's Knowledge Defended by Archaeologist

NEW TRIBUTE to Shakespeare as a historian is paid by an archaeologist of the British Museum, Christopher Hawkes, who is in charge of excavations at the city of Shakespeare's King Cymbeline.

Ruins on the edge of the modern city of Colchester are identified as the capital of the British King Cymbeline. The reign of Cymbeline lasted 40 years while Roman Emperors laid their plans to conquer the barbarian Britons.

"The more we come to know of Britain on the eve of the Roman conquest, the clearer it becomes that Shakespeare, searching among the chronicler's welter of fact and fiction for the outlines of the play he was conceiving, brought out the main features of it with the instinct of genius for truth," declares Mr. Hawkes in a report of the excavations at Colchester, in *Art and Archaeology*.

Latest excavations have unearthed some of the homes in Cymbeline's capital city. The excavations were undertaken, speedily, when the site was threatened by road building and real estate developments. Some years ago, archaeologists had dug into a mound on the land and discovered a Celtic burial so magnificent that it may be that of King Cymbeline himself. The palace of the king is still being sought. Cymbeline's mint, which issued coinage of great historic interest, is another future discovery.

Cymbeline's capital, the metropolis of southeastern Britain, covered a huge area, Mr. Hawkes explains. Excavations reveal the foundations of homes made of timber framework with walls of wattle and daub. Houses and town changed somewhat during Cymbeline's reign, and Mr. Hawkes suggests that Cymbeline may have made an early effort at town planning in his capital.

Showing primitive features of the Celtic capital, Mr. Hawkes tells of a great ditch which was dug with shovels made of the blade bones of oxen.

"Thirty or forty of these crude tools—the type was in use as long ago as the Stone Age—were found discarded in a heap on the gravel bottom," he writes.

The huddled mass of primitive dwellings may give place to more ambitious structures, Mr. Hawkes believes, when the excavations approach nearer the heart of the city. Here the king himself must have resided. In this section, the archaeologist also is prepared to find tools more serviceable than bone shovels. The town was far from being wholly primitive, he explains. Among the objects already discovered are pottery of graceful profile and metal work of amazingly high standard.

Cymbeline's capital is a site of unparalleled importance in British archaeology, Mr. Hawkes states. Not only is the native civilization of Cymbeline's subjects shown at its highest, but the archaeologist can study what happened when Roman civilization met British. The city was not abandoned for seven years after the Roman legions captured it in 43 A. D.

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ASTRONOMY

Interesting Delporte Object Keeps Astronomers Guessing

A SMALL point of light in the heavens is pronounced by Dr. Fred L. Whipple of Harvard College Observatory "the most interesting and puzzling body of the solar system since the discovery of Pluto." It is the Delporte object discovered by Prof. E. Delport, Belgian astronomer, on March 9.

It has kept the astronomers of the world guessing as to whether it is a comet or an asteroid. Dr. Whipple and L. E. Cunningham, after computations of two sets of elements to determine its path in the heavens, are of the opinion that it is a comet and possibly identical with Comets 1858 III and 1907 III. Further computations of the influence of the earth upon the object must be made to determine whether the Delporte object is actually this older comet on a return to the vicinity of the earth.

"The very rapid motion, 2.5 degrees per day, and faintness indicated a very close approach of a small object naturally suspected of being an asteroid because of its stellar appearance," said Dr. Whipple. "Its orbital elements were very difficult to determine accurately even from an apparent arc of fifteen degrees because its motion was nearly in a great circle. No comet or asteroid can move in this fashion for any length of time, but the peculiar coincidence of position in the sky and plane of orbital motion enabled the Delporte object to move fifteen degrees in a great circle with a deviation of only a minute of arc for about six days.

"The orbital elements when more accurately determined were on the borderline between asteriod and comet, appearing, however, more asteroidal than cometary. The eccentricity of 0.5 and period of approximately three years are distinctly those of an asteriod although the orbit plane and perihelion distance are very similar to those of the comets of 1907 III and 1858 III. A period of about three years as computed by Cunningham and myself would indicate that the body without being observed had passed perihelion seven times between 1907 and 1932, in case it is identical with 1907 III. This seems perfectly possible because at its opposition the body was rather faint (magnitude 13) when observed at a distance of only 0.92 astronomical units. The distance from the earth would have been much greater at other perihelion passages. It seems less probable but still possible that the object was not observed between 1858 and 1907, in spite of the greater brightness in past years, this possibility being due to the rapidity of its motion at opposition.

"Prof. Van Biesbroeck of the Yerkes Observatory states that on April 5 the object had decreased in brightness to the fifteenth magnitude from the thirteenth magnitude late in March. This behavior is characteristic of a comet and not of an asteroid."

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A New Student's Resistance Box

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PHYSICS

Steel-Like Glass Permits Centrifuge Observations

GLASS almost as strong as steel now makes it possible to observe what happens in the "ultra-centrifuge" invented by Dr. J. W. Beams and A. J. Weed of the University of Virginia. Hitherto this has not been possible because the instrument spins so fast that it would very quickly break any ordinary glass. The new glass was made by the Corning Glass Company.

The ultra-centrifuge with the new transparent top was described here today at the meeting of the Virginia Academy of Science. It is an improvement over the original models, which were made entirely of metal. The instrument consists of a hollow, top-shaped rotor with diagonal vanes on its conical under surface. It spins in a funnel-shaped cup, driven by a jet of air at high pressure admitted from underneath. This both whirls the rotor and lifts it free of the cup, so that it runs on a cushion of air. In this way it is possible to obtain terrific speeds of rotation. Most of the ultra-centrifuges thus far built have rotational speeds approaching a quarter of a million revolutions a minute; but one small experimental model has been constructed with which a speed of half a million revolutions a minute has been obtained.

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ASTRONOMY

Spiral Nebula in Andromeda Bordered With Star Clusters

See Front Cover

TINY FLECKS of hazy light around the borders of one of the most famous of the spiral nebulae, the one in the constellation Andromeda, are now believed to be great globular clusters of stars—literally swarms of suns crowded like clouds of gnats that hang over the marshes at twilight.

This provisional identification was made by Dr. Edwin Hubble of the Mt. Wilson Observatory of the Carnegie Institution of Washington, after a careful study of 140 objects. Their astronomical behavior led him to the conclusion that they are probably star clusters, similar to the easily identified clusters that belong to our own particular part of the starry universe. Prof. Hubble's report was presented before the National Academy of Sciences.

The Andromeda nebula is one of the most famous of these great "pinwheels of the sky," whose spiral structure can be discerned only by means of the most powerful telescopes. Although it consists of so many thousands of stars that the 140 probable clusters on its border are mere incidents of its structure, it can barely be seen as a bit of light by the naked eye. This is because it is so immensely distant from the galaxy to which our own solar system belongs. Its distance has been measured as 900,000 light-years.

On the cover of this week's SCIENCE NEWS LETTER is a photograph of a typical star cluster. It is not one of Prof. Hubble's 140 Andromeda objects, which are too far away to show so much detail, but one belonging to our own galaxy. It serves, however, to illustrate the great beauty of these symmetrical crowded masses of stars. The photograph was made at the Mt. Wilson Observatory.

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BOTANY

NATURE RAMBLINGS *by Frank Thone*

Spring Beauty

WHEN a small child scampers back to its mother, after its first adventurous sally into the Great Big Woods, it is sure to have, among the flowers clutched tight in its chubby fist, a generous proportion of spring beauties. These pretty little starshaped flowers are so abundant, so widely distributed, so persistent in spring blossoming, that they shine brightly in the early memories of all of us, in whatever part of the land we were bred.

Spring beauties are peculiarly adapted to childish flower-gathering. To many of our wildflowers a small child is really a destructive ogre, for its innocent technique is to take hold and pull, usually uprooting and killing the plant. But the spring beauty is deeply anchored to a round, thickened underground stem or corm, from which its slender, two-leaved aerial stem climbs upward its few inches to end in its little cluster of stars. So when the stem is pulled at it simply lets go of the corm and comes up, leaving the stored food below with perhaps another chance of life. No one has ever yet pulled a spring beauty up by the roots. Little though the plant is, if you want it roots and all you have to use a spade.

There are three species of spring beauty, though they all look so much alike that the ordinary observer will see no difference between them. One of the three is a Rocky Mountain flower, and does not come east, but the other two range from the prairies, or even the great plains, eastward to the Atlantic, and south to the Gulf. No child anywhere east of the Rockies need be without the privilege of acquaintance with the spring beauty.

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PLANT PHYSIOLOGY

Submarines May Carry Tomato Plants to Detect Gas Leaks

CREWS of submarines may in future carry potted tomato plants with them, as sailors on bigger ships have parrots and goats. Only these green mascots will not be merely pets; like everything else in the crowded interior of a "sub," they will have to pay their way. And they can do it by giving warning of gas leaks, long before even that most sensitive of animal detectives, the canary, could detect them.

This is one of the possible uses for the peculiar behavior of plants in the presence of ethylene gas that was suggested by Dr. William Crocker of the Boyce Thompson Institute for Plant Research, speaking at American Philosophical Society's meeting in Philadelphia.

Plants could also be used to detect dangerous gases in garages and other closed spaces where men are at work, Dr. Crocker suggested.

The value of many plants, and especially the tomato plant, for this purpose depends on the curious behavior of their petioles or leaf-stems in the presence of very dilute quantities of ethylene gas, which is a common ingredient of illuminating gas and is also invariably present when the poisonous carbon monoxide is being generated. Dilutions of ethylene as low as one part in ten million of air will cause tomato leaf-stems to begin growing on the upper sides where they did not grow before, thus causing them to bend downward instead of up. This effect was first demonstrated several years ago by Sarah L. Doubt, and has since been the subject of much research by Dr. Crocker and other plant physiologists.

Curiously enough, if a potted plant is turned upside down and then exposed to ethylene, it does not react. It behaves as though it were confused, not knowing which way to turn. The secret of this lies in the fact that the growth direction of the leaves is really a response to the pull of gravity, and the ethylene, by anesthetizing the plant, destroys its ability to respond normally to this stimulus.

Not all plants are sensitive to ethylene, however. Dr. Crocker mentioned the common Boston fern, which remained unaffected by the gas in atmospheres containing 90 per cent of it. On plants sensitive to its action, ethylene has a whole series of effects, which Dr. Crocker and his associates have studied. Among other effects, it produced a slowing down in the rate of growth in length, it brought about a destruction of chlorophyll in rose leaves, it caused leaves to fall off from many plant species. In smaller concentrations it has been used commercially for a number of years in the artificial ripening of many fruits and vegetables.

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First Glances at New Books

Ethnology

THE OZARKS: AN AMERICAN SURVIVAL OF PRIMITIVE SOCIETY—Vance Randolph—*Vanguard Press*, 310 p., $5. Mr. Randolph has given a plain and precise title to a most diverting and informative book. The Ozark "hill-billies" whom he describes are extraordinary Americans, who can scarcely be imagined as contemporaries of the people on Broadway and Main Street. The chapter on Ozark dialect, in which numerous queer turns of speech are cited and accounted for, is perhaps one of the best. But there are also chapters on the parties and religion, the superstitions and the taboos of the hill country, all highly interesting.

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Radio

HOW TO BECOME A RADIO AMATEUR—*American Radio Relay League*, 30 p., 25c. This pamphlet has introduced many people old and young, to a fascinating hobby. Before the days of broadcasting, amateur radio plowed the ether for radio as we now have it in our homes. Today amateurs talk with the ends of the earth. The pamphlet is in its second edition.

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Chemistry

CHEMISTRY FOR SECONDARY SCHOOLS — Ernest L. Dinsmore—*Laurel Book Company*, 586 p., $1.68. A straightforward and well illustrated text that should be attractive to the right sort of student. The author is chairman of the chemistry department of the Boys' High School of Brooklyn.

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Bibliography

SCIENCE READING MATERIAL FOR PUPILS AND TEACHERS—C. M. Pruitt—*Reprint from Science Education*, 28 p. 20c. A very useful list arranged by grade and by subject.

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Entomology

FUNDAMENTALS OF INSECT LIFE—C. L. Metcalf and W. P. Flint—*McGraw-Hill Book Co.* 581 p., $4. The authors of a successful work on economic entomology have here expanded their field for the benefit of students who are interested primarily in the biology and ecology of insects. Like *Destructive and Useful Insects*, this new book is characterized by clearness of exposition and adequacy in selection of material for treatment. There are plenty of good illustrations.

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Exploration

ARABIA FELIX—Bertram Thomas—*Scribner*, 397 p., $5. In a foreword, the famous Colonel T. E. Lawrence describes the author as "the compleat Arabian traveller enshrined." Today, when explorers set out in efficient-looking airplanes and motor cars, Captain Thomas made his journey across the Great Southern Desert on camel-back. The story of his adventures stresses new facts which he learned about the happy land. Almost a hundred pages at the close of the book are given to scientific data, including an appendix on "The Racial Characters of the Southern Arabs" by Sir Arthur Keith and Dr. W. M. Krogman.

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Automotive Engineering

ENGLISH - FRENCH COMPREHENSIVE DICTIONARY OF THE AUTOMOBILE AND ALLIED INDUSTRIES—Lewis L. Sell—*International Dictionary Co.*, 769 p., $6. A useful addition to the specialized dictionaries of the two languages, this book was compiled as an aid to the tourist in Europe as well as the automotive industry. It contains 150,000 technical terms in both languages. Research scientists and teachers touching upon the automotive field will find it valuable.

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General Science

ANNUAL REPORT, FIELD MUSEUM OF NATURAL HISTORY, 1931—*Field Museum*, 287 p., 22 pl., $1. The account of a year's progress in one of the leading museums of America.

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Zoology

ZOOLOGY — F. E. Chidester — *Van Nostrand*, 581 p., $3.75. A solid, well-organized textbook for college and university use, which the student can use to very good advantage for a reference book after he has finished the prescribed course.

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Biography

HUXLEY—Clarence Ayres—*Norton*, 254 p., $3. A vividly written biography of one of the most pungent and pugnacious figures of the seething nineteenth century, the Aaron of the Darwinian exodus from traditional biology; the Paul who popularized the new doctrine, carried it to the Gentiles outside the learned circles to which Darwin first addressed himself, and either converted or confounded all who had the temerity to enter the lists against him.

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Psychology-Heredity

MENTAL TESTS AND HEREDITY—Barbara Schieffelin and Gladys C. Schwesinger—*Galton Publishing Co.*, 283 p., 90c paper, $1.15 cloth. The outcome of a search for "tests of innate ability" made under the direction of the Eugenics Research Association and the Carnegie Institution of Washington. The book, and particularly the included survey of non-verbal tests, will be welcomed by anyone interested in testing technique.

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Nature Study

FLORIDA WILD LIFE—C. T. Simpson—*Macmillan*, 199 p., $2.50. Florida has long been popular with those who like to add a little more or less studious nature observation to their winter vacationing; and with the prospect of a great national park becoming established in the Everglades, this aspect of the state's attractiveness is bound to assume increasing importance. The appearance of the present book is therefore most timely.

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History

THE EPIC OF AMERICA—James Truslow Adams—*Little, Brown and Co.*, 433 p., $3.75. This splendid one-volume history of America sounds a note of hope for and faith in the American ideal—the American dream, Mr. Adams calls it—which is particularly welcome at a time when contemplation of the American scene is too apt to bring only despair and disillusion.

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